

Ion source developments for heavy element research

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The low cross section experiments for the synthesis of new isotopes and elements in the transactinide and superheavy element region demand intense heavy ion beams (10^{13} particle/sec and higher on target). The duration of these experiments is long (> 200 hours), and frequently accelerated beams of neutron rich isotopes are required. These requirements present a challenge to accelerator injector systems. Therefore, a concentrated ion beam development program is necessary to be able to produce sufficient beam intensities for heavy element experiments.

In addition, high production efficiencies for those high intensity heavy ion beams are desired for various reasons: First, rare isotopes like ^{48}Ca , ^{36}S , or ^{85}Rb are very expensive (for example 250000\$/g ^{48}Ca). Secondly, it is unpractical to reload the oven during long experiments for beams made from solid material. Third, it is desirable to minimize the contamination of the ion source for consecutive runs.

The production of heavy ion beams from solids and gases will be reviewed briefly. Electron cyclotron resonant ion source (ECRIS) development required for heavy element research is described in more detail. The development of an intense ^{48}Ca ion beam at LBNL is described as an example for methods to optimize ion source ionization efficiency.